National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 9641E (DSI-9641E)

State, Regional, and National Monthly and Annual Area-weighted Temperature and Precipitation and Population-weighted Heating And Cooling Degree Days, 1931-91

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1. Abstract: This data set is also known as HISTORICAL CLIMATOLOGY SERIES 4-1, 4-2, 5-1, and 5-2.

The data in this data set are based on climate division monthly mean temperature, precipitation, and heating and cooling degree days (see DSI-9641: MONTHLY DIVISIONAL NORMALS AND STANDARD DEVIATIONS, FROM 1931-90, OF TEMPERATURE, PRECIPITATION, AND HEATING AND COOLING DEGREE DAYS). A climate division represents a region within a state that is climatically quasi-homogeneous, for example a crop reporting district or river drainage basin (Owenby et al., 1992a). Each month, averages of temperature and precipitation are calculated for state climatic divisions by simple averaging of data from all stations within the division that record both temperature and precipitation. Monthly heating and cooling degree day totals for the divisions are then derived from the division's monthly mean temperature using an estimation technique developed by Thom (1954a, 1954b, 1966). The degree day model developed by Thom computes monthly degree days using the monthly temperature values and the standard deviation of the temperature values over a standardizing period. The standardizing period used for this data set was 1931-90. The Thom model was used to compute derived sequential monthly heating and cooling degree days for January 1931 to December 1991 (through June 1992 for heating degree days) for each division, based on the division's sequential monthly temperature data (Owenby et al., 1992b).

This data set's sequential state average temperature and precipitation values for each month were derived from the corresponding divisional values by weighting each division by its percentage of the total state area. The nation was divided into nine census regions as defined and used by the Bureau of the Census. Sequential regional temperature and precipitation values were computed from the state average values by weighting each state in the region by its percentage of the total regional area. National values were computed from the regional values by weighting each region in the contiguous United States according to its percentage of the total national area. The national value, therefore, covers only the contiguous United States. The area weights are listed in Heim et al. (1993a, 1993b). Annual values were computed by summing (precipitation) or averaging (temperature) the corresponding monthly values.

This data set's sequential state average heating and cooling degree day values for each month were derived from the divisional values by weighting each division by its percentage of the total state population as adduced from the 1990 census data. The divisional population values were computed from the county population values for those counties in a division. Metropolitan population values were used to weight county population values for counties crossing divisional boundaries. Sequential regional degree day values were computed from the state average values by weighting each state in the region by its percentage of the total regional population. National values were computed from the regional values by weighting each region in the contiguous United States by its percentage of the corresponding national population. The population weighting procedure assures that degree-day averages for the States, Regions, and Nation as a whole are biased toward conditions existing in the more populous sections. The population weights are listed in Heim et al. (1993c, 1993d). Annual values for each year were computed by summing the corresponding monthly values. ***It should be noted that the sequential degree day values in this data set will differ from the previously-published values for the same periods due to the different Thom standardizing period and different population weights used in the computations.***

The nine census regions and their corresponding states are listed below:

(1) New England: CT, ME, MA, NH, RI, VT
(2) Middle Atlantic: NJ, NY, PA
(3) East North Central: IL, IN, MI, OH, WI
(4) West North Central: IA, KS, MN, MO, NE, ND, SD
(5) South Atlantic: DE, FL, GA, MD, NC, SC, VA, WV
(6) East South Central: AL, KY, MS, TN
(7) West South Central: AR, LA, OK, TX
(8) Mountain: AZ, CO, ID, MT, NV, NM, UT, WY
(9) Pacific: CA, OR, WA

Long-term means and standard deviations were computed for the following periods: 1931-60, 1941-70, 1951-80, 1961-90, 1931-90, and 1931-91. The means for each of the twelve calendar months were computed by adding the values from the appropriate time period then dividing by the number of years (i.e., 30, 60, or 61) in the period. For temperature, the annual means were computed by adding all of the monthly mean values and then dividing by 12. For precipitation and degree days, the annual means were computed by adding the 12 monthly mean values. The monthly and annual standard deviations for each period were computed from the corresponding monthly and annual sequential values.

The eight files in this data set contain the historical sequential data and 30-year, 60-year, and 61-year means and standard deviations (for 1931-60, 1941-70, 1951-80, 1961-90, 1931-90, and 1931-91) of monthly and annual (seasonal) area-weighted mean temperature and total precipitation and population-weighted heating and cooling degree days for the 48 contiguous states, Alaska, Puerto Rico, the Virgin Islands, nine census regions, and the contiguous United States. Note: not all elements are computed for Alaska, Puerto Rico and the Virgin Islands.

Values for climate divisions were computed by averaging the values from the stations within the climate division. Statewide, regional and national values were computed by area-weighting (temperature and precipitation) or population-weighting (degree days) the values from the climate divisions, states and regions, respectively. The sizes and dimensions of the divisions, states and regions vary.

2. Element Names and Definitions:

The data in this data set are archived on one magnetic tape. This tape contains the long-term means, standard deviations, and historical sequential monthly area-weighted temperature and precipitation and population-weighted heating and cooling degree day data from 1931-91 (July 1931-June 1992 for heating degree days) in eight parameter-dependent files. The data were computed for the 49 continental states, Puerto Rico, the Virgin Islands, nine census regions in the contiguous United States, and a national value (of the 48 contiguous states). The means and standard deviations were computed for several periods. Each file has the following format:

Columns	Description
1- 1	Element Code. Values are: 1 = mean temperature 2 = total precipitation 3 = heating degree days

4 = cooling degree days

2- 5 State/Region Identifier Codes. This identification code section is divided into two parts: Columns 2-3 and Columns 4-5, as follows:

2- 3 Primary Identifier Code. Values are:

01 Alabama	19 Massachusetts	37 Rhode Island
02 Arizona	20 Michigan	38 South Carolina
03 Arkansas	21 Minnesota	39 South Dakota
04 California	22 Mississippi	40 Tennessee
05 Colorado	23 Missouri	41 Texas
06 Connecticut	24 Montana	42 Utah
07 Delaware	25 Nebraska	43 Vermont
08 Florida	26 Nevada	44 Virginia
09 Georgia	27 New Hampshire	45 Washington
10 Idaho	28 New Jersey	46 West Virginia
11 Illinois	29 New Mexico	47 Wisconsin
12 Indiana	30 New York	48 Wyoming
13 Iowa	31 North Carolina	49 not used
14 Kansas	32 North Dakota	50 Alaska
15 Kentucky	33 Ohio	58 A Census Region
16 Louisiana	34 Oklahoma	59 National Region
17 Maine	35 Oregon	66 Puerto Rico
18 Maryland	36 Pennsylvania	67 Virgin Islands

4- 5 Secondary Identifier Code. Values are defined as follows. If the Primary Identifier Code is 01-50 or 59-67, then the Secondary Identifier Code is 99. If the Primary Identifier Code is 58, then the Secondary Identifier Code has the following values:

01 = New England Region
02 = Middle Atlantic Region
03 = East North Central Region
04 = West North Central Region
05 = South Atlantic Region
06 = East South Central Region
07 = West South Central Region
08 = Mountain Region
09 = Pacific Region

6- 9	Beginning Year for the Record
10-13	Ending Year for the Record
14-18	Data Value for January
19-23	Value for February
24-28	Value for March
29-33	Value for April
34-38	Value for May
39-43	Value for June
44-48	Value for July
49-53	Value for August
54-58	Value for September
59-63	Value for October
64-68	Value for November
69-73	Value for December
74-79	Annual Value

80-80 Statistic Code. Values are:
1 = sequential year-month data
2 = mean for Beginning Year to Ending Year
3 = standard deviation for Beginning Year to Ending Year

81-81 Weighting Code. Values are:
1 = data weighted by population
2 = data weighted by area

82-84 Degree Day Base Temperature

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FIRST FILE: SEQUENTIAL TEMPERATURE

The first file contains the sequential monthly and annual temperature values for January 1931 to December 1991. The following values coded in the following record fields are specific to this file:

Record Field	Value
Element Code (column 1):	1
Beginning Year (col. 6-9):	a year (from 1931-1991) for this record
Ending Year (col. 10-13):	same as Beginning Year
Statistic (col. 80):	1
Weighting Code (col. 81):	2
Degree Day Base (col. 82-84):	not used

The monthly and annual values are coded to tenths of a degree Fahrenheit.

SECOND FILE: TEMPERATURE MEANS AND STANDARD DEVIATIONS

The second file contains the monthly and annual 30-year, 60-year, and 61-year (period of record) means and standard deviations for temperature. The Beginning Year and Ending Year fields identify the period for the means or standard deviations. The following values coded in the following record fields are specific to this file:

Record Field	Value
Element Code (column 1):	1
Beginning Year (col. 6-9):	1931,1941,1951,1961
Ending Year (col. 10-13):	1960,1970,1980,1990,1991
Statistic (col. 80):	2,3
Weighting Code (col. 81):	2
Degree Day Base (col. 82-84):	not used

The monthly and annual values are coded to tenths of a degree Fahrenheit.

THIRD FILE: SEQUENTIAL PRECIPITATION

The third file contains the sequential monthly and annual precipitation values for January 1931 to December 1991. The following values coded in the following record fields are specific to this file:

Record Field	Value
Element Code (column 1):	2
Beginning Year (col. 6-9):	a year (from 1931-1991) for this record
Ending Year (col. 10-13):	same as Beginning Year
Statistic (col. 80):	1
Weighting Code (col. 81):	2
Degree Day Base (col. 82-84):	not used

The monthly and annual values are coded to hundredths of an inch.

FOURTH FILE: PRECIPITATION MEANS AND STANDARD DEVIATIONS

The fourth file contains the monthly and annual 30-year, 60-year, and 61-year means and standard deviations for precipitation. The Beginning Year and Ending Year fields identify the period for the means or standard deviations. The following values coded in the following record fields are specific to this file:

Record Field	Value
Element Code (column 1):	2
Beginning Year (col. 6-9):	1931,1941,1951,1961
Ending Year (col. 10-13):	1960,1970,1980,1990,1991
Statistic (col. 80):	2,3
Weighting Code (col. 81):	2
Degree Day Base (col. 82-84):	not used

The monthly and annual values are coded to hundredths of an inch.

FIFTH FILE: SEQUENTIAL HEATING DEGREE DAYS

The fifth file contains the sequential monthly and annual (i.e., seasonal) heating degree day values for July 1931 to June 1992. Each record lists the values for a heating degree day season, which runs from July of the previous year to June of the current year. Consequently, the Ending Year field will identify the season year, and the Beginning Year field will contain the previous year (i.e., Ending Year minus one). The first monthly value field (columns 14-18) will contain the value for July, the next monthly value field (columns 19-23) will contain the value for August, and so forth, with the last monthly value field (columns 69-73) containing the value for June. The annual value is the total of the twelve months (July-June) for that season. The following values coded in the following record fields are specific to this file:

Record Field	Value
Element Code (column 1):	3
Beginning Year (col. 6-9):	a year (from 1931-1991) (Ending Year minus 1)
Ending Year (col. 10-13):	a year (from 1932-1992) for this season
Statistic (col. 80):	1
Weighting Code (col. 81):	1
Degree Day Base (col. 82-84):	065

The monthly and annual (seasonal) values are coded to whole units in degrees Fahrenheit. **The heating degree days are a derived quantity computed using the**

Thom algorithm with a new standardizing period and using new (1990 census) population weights (see Topic 18: Data Derivation Algorithms). THEREFORE, ANY COMPARISON WITH PREVIOUSLY PUBLISHED VALUES WOULD BE MISLEADING.

SIXTH FILE: HEATING DEGREE DAY MEANS AND STANDARD DEVIATIONS

The sixth file contains the 30-year, 60-year, and 61-year means and standard deviations for heating degree days. The Beginning Year and Ending Year fields identify the period for the means or standard deviations. A heating degree day season runs from July through June. Consequently, the value for July is listed in the first monthly value field (columns 14-18), August is listed in the second monthly value field (columns 19-23), and so forth, with June listed in columns 69-73. The following values coded in the following record fields are specific to this file:

Record Field	Value
Element Code (column 1):	3
Beginning Year (col. 6-9):	1931,1941,1951,1961
Ending Year (col. 10-13):	1960,1970,1980,1990,1991
Statistic (col. 80):	2,3
Weighting Code (col. 81):	1
Degree Day Base (col. 82-84):	065

The monthly and annual values are coded to tenths of a degree Fahrenheit. **The heating degree days are a derived quantity computed using the Thom algorithm with a new standardizing period and new (1990 census) population weights THEREFORE, ANY COMPARISON WITH PREVIOUSLY-PUBLISHED VALUES WOULD BE MISLEADING.**

SEVENTH FILE: SEQUENTIAL COOLING DEGREE DAYS

The seventh file contains the sequential monthly and annual cooling degree day values for January 1931 to December 1991. A cooling degree day season runs from January to December, so the seasonal value is the annual value for the indicated year. The following values coded in the following record fields are specific to this file:

Record Field	Value
Element Code (column 1):	4
Beginning Year (col. 6-9):	a year (from 1931-1991) for this record
Ending Year (col. 10-13):	same as Beginning Year
Statistic (col. 80):	1
Weighting Code (col. 81):	1
Degree Day Base (col. 82-84):	065

The monthly and annual values are coded to whole units in degrees Fahrenheit. **The cooling degree days are a derived quantity using the Thom algorithm with a new standardizing period and new (1990 census) population weights (see Data Derivation Algorithms). THEREFORE, ANY COMPARISON WITH PREVIOUSLY-PUBLISHED VALUES WOULD BE MISLEADING.**

EIGHTH FILE: COOLING DEGREE DAY MEANS AND STANDARD DEVIATIONS

The eighth file contains the 30-year, 60-year, and 61-year means and standard deviations for cooling degree days. The Beginning Year and Ending Year fields identify the period for the means and standard deviations. The following values coded in the following record fields are specific to this file:

Record Field	Value
Element Code (column 1):	4
Beginning Year (col. 6-9):	1931,1941,1951,1961
Ending Year (col. 10-13):	1960,1970,1980,1990,1991
Statistic (col. 80):	2,3
Weighting Code (col. 81):	1
Degree Day Base (col. 82-84):	065

The monthly and annual values are coded to tenths of degrees Fahrenheit. **The cooling degree days are a derived quantity computed using the Thom algorithm with a new standardizing period and new (1990 census) population weights (see Data Derivation Algorithms). THEREFORE, ANY COMPARISON WITH PREVIOUSLY-PUBLISHED VALUES WOULD BE MISLEADING.**

3. Start Date: 19310101 for sequential temperature, precipitation, and cooling degree days. 19310701 for sequential heating degree days, means and standard deviations for the periods 1931-60, 1941-70, 1951-80, 1961-90, 1931-90, and 1931-91.

4. Stop Date: 19911231 for sequential temperature, precipitation, and cooling degree days. 19920630 for sequential heating degree days, means and standard deviations for the periods 1931-60, 1941-70, 1951-80, 1961-90, 1931-90, and 1931-91.

5. Coverage: Statewide values for the 49 continental United States, Puerto Rico, and the Virgin Islands, nine census regions within the contiguous United States, and a national value covering the contiguous United States.

a. Southernmost Latitude: 17N
b. Northernmost Latitude: 72N
c. Westernmost Longitude: 65W
d. Easternmost Longitude: 172E

6. How to Order Data:

Ask NCDC's Climate Services about the cost of obtaining this data set.
Phone: 828-271-4800
FAX: 828-271-4876
E-mail: NCDC.Orders@noaa.gov

7. Archiving Data Center:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

8. Technical Contact:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

9. Known Uncorrected Problems: None.

10. Quality Statement: High quality. Station data is QC'd at monthly scale (all stations), daily scale (Cooperative stations), and hourly scale (First Order stations).

11. Essential Companion Datasets: None.

12. References:

Heim, Jr., R.R., C. Garvin, and L. Nicodemus, 1993a: HISTORICAL CLIMATOLOGY SERIES 4-1: STATE, REGIONAL, AND NATIONAL MONTHLY AND ANNUAL TEMPERATURE WEIGHTED BY AREA FOR THE UNITED STATES, JANUARY 1931-DECEMBER 1991. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

Heim, Jr., R.R., C. Garvin, and L. Nicodemus, 1993b: HISTORICAL CLIMATOLOGY SERIES 4-2: STATE, REGIONAL, AND NATIONAL MONTHLY AND ANNUAL PRECIPITATION WEIGHTED BY AREA FOR THE UNITED STATES, JANUARY 1931-DECEMBER 1991. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

Heim, Jr., R.R., C. Garvin, and L. Nicodemus, 1993c: HISTORICAL CLIMATOLOGY SERIES 5-1: STATE, REGIONAL, AND NATIONAL MONTHLY AND SEASONAL HEATING DEGREE DAYS WEIGHTED BY POPULATION (1990 CENSUS), JULY 1931-JUNE 1992. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

Heim, Jr., R.R., C. Garvin, and L. Nicodemus, 1993d: HISTORICAL CLIMATOLOGY SERIES 5-2: STATE, REGIONAL, AND NATIONAL MONTHLY AND ANNUAL COOLING DEGREE DAYS WEIGHTED BY POPULATION (1990 CENSUS), JANUARY 1931-DECEMBER 1991. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

Owenby, J.R., C. Garvin, L. Nicodemus, and R.R. Heim Jr., 1992a: CLIMATOGRAPHY OF THE UNITED STATES NO. 85: DIVISIONAL TEMPERATURE AND PRECIPITATION NORMALS AND STANDARD DEVIATIONS, 1931-1990. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

Owenby, J.R., C. Garvin, L. Nicodemus, and R.R. Heim Jr., 1992b: CLIMATOGRAPHY OF THE UNITED STATES NO. 85: DIVISIONAL HEATING AND COOLING DEGREE DAY NORMALS AND STANDARD DEVIATIONS, 1931-1990. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

Thom, H.C.S., 1954a: "The rational relationship between heating degree days and temperature", MONTHLY WEATHER REVIEW, vol. 82, pp. 1-6.

Thom, H.C.S., 1954b: "Normal degree days below any base", MONTHLY WEATHER REVIEW, vol. 82, pp. 111-115.

Thom, H.C.S., 1966: "Normal degree days above any base by the universal truncation coefficient", MONTHLY WEATHER REVIEW, vol. 94, pp. 461-465.